REMARKS

This application has been amended. In particular, claims 1, 3, 7, and 8 have been amended to further clarify that the pre-treatment step occurs prior to applying electroless plating to the polymer electrolyte. Support for this amendment can be found throughout the specification as filed, such as on page 19 of the application as filed, which describes the electroless plating as occurring after completing the swelling step. In addition, claims 3 and 8 have been amended to clarify that the adsorption and reduction steps are part of the electroless plating step. Support for this amendment can be found throughout the application as filed, such as on page 19 which describes the electroless plating as including both an absorption step and reduction step. Claims 1, 2, 3, 7 and 8 have been amended to define the thickness of the polymer electrolyte obtained in the swelling step to be at least 130% of that of the polymer electrolyte in the dry state. Support for this amendment can be found, for instance, in the Examples section of the application, and particularly in Tables 1 and 2 on pages 50 and 51 and the discussion summarizing the results on pages 52-54. Thus, no new matter has been added. The foregoing amendments should be entered because they reduce the outstanding issues, place the application in better condition for allowance or appeal, and do not require further search or consideration.

In view of the foregoing amendments and following remarks, Applicants respectfully request that the outstanding rejections be reconsidered and withdrawn and that pending claims 1-8, 13-14 and 16-23 be allowed.

Restriction Requirement

The Office Action asserts that newly added claims 20 and 21 are directed to an invention that is independent from the originally claimed invention because claims 20 and 21 provide for the use of a different solvent than that recited in claims 5, 6, 13 and 14. While Applicants respectfully disagree that this difference justifies a restriction or that searching the invention of claims 20 and 21 would impose any additional search burden, Applicants note that claim 1 is generic to claim 20 and claim 3 is generic to

claim 21. Thus, Applicants respectfully request reconsideration of the restriction upon a finding that claims 1 and 3 are allowable.

Rejections Under 35 U.S.C. §112, second paragraph

Claims 1-8, 13, 14 and 16-23 stand rejected under 35 U.S.C. § 112, second paragraph for indefiniteness. In view of the amendments to the claims, this rejection is respectfully traversed.

The Office Action first asserts that what is meant by a "pre-treatment step" is unclear since the claims fail to clarify what the pre-treatment step precedes. For purposes of examination, the pre-treatment step was treated as occurring before the electroless plating. This understanding as to the timing of the pre-treatment step is correct. The pre-treatment step is a separate step which precedes the electroless plating. Claims 1, 3, 7, and 8 have been amended to clarify that the pre-treatment step occurs prior to applying electroless plating to the polymer electrolyte. It is believed this amendment to the claims is sufficient to overcome this rejection.

Second, with respect to claims 3 and 8, the Office Action questions whether the "adsorption step" and "reduction step" are part of the "electroless plating" or if these steps are instead part of some other step. Applicants submit that these steps are part of the electroless plating. Applicants have amended claims 3 and 8 to specifically define an electroless plating step which comprises the adsorption step and reduction step. Applicants believe this amendment is sufficient to overcome this rejection.

Third, the Office Action asserts that claims 22 and 23 are confusing as to whether the laminate is formed into an actuator element or whether the actuator element is used in a process. Applicants respond by stating that the laminate referred to in claims 22 and 23 corresponds to the actuator itself. Upon applying voltage to the laminate, the laminate will, for instance, flex, so that the laminate will function as an actuator. Thus, the claim is directed to an actuator element, where the actuator element is defined as being formed according to a certain process.

Therefore, Applicants submit that the amended claims are sufficiently clear and precise to be understood by one skilled in the art. Thus, the rejection of claims 1-8, 13, 14 and 16-23 under 35 U.S.C. §112, second paragraph for indefiniteness should be reconsidered and withdrawn.

Rejections Under 35 U.S.C. §103(a)

Claims 1-5, 7, 8, 13 and 16-23 stand rejected under 35 U.S.C. §103(a) for obviousness over U.S. Patent No. 4,959,132 to Fedkiw, Jr. in view of the admitted state of the prior art. Claims 6 and 14 stand rejected under 35 U.S.C. §103(a) for obviousness over Fedkiw in view of the admitted state of the art and further in view of U.S. Patent No. 5,024,858 to Burch. These rejections are respectfully traversed.

Fedkiw is directed to a two-step process for preparing metallic electrocatalytic films embedded proximate to one or both of the surfaces of a solid polymer electrolyte membrane. (Fedkiw, 4:28-29.) The first step is an impregnation process in which a solid polymer electrolyte membrane is impregnated with an ionic salt or salts of the desired metal, ideally through the saturation of the membrane with a cationic metal salt solution. (Fedkiw, 4:29-38.) The second step of the two-step process is a reduction step in which an electrocatalytic film is formed on one face of the membrane. (Fedkiw, 4:50-52.) The reduction step causes a chemical reduction of the impregnated metallic cations to the metal(0) state and the formation of an electrocatalytic film proximate the membrane surface. (Fedkiw, 4:58-61.)

Fedkiw does not teach or suggest a method for electroless plating that includes a pre-treatment swelling that occurs before electroless plating. As discussed above, Fedkiw is directed to a two-step, adsorption/reduction process. Thus, the initial immersion of the polymer electrolyte in a solvent and ionic salt of the selected metal is not a pre-treatment swelling step that occurs before electroless plating, but is instead part of the plating step, and particularly the absorption portion of the plating process.

Modifying the process of Fedkiw, such that the absorption and reduction steps are repeated multiple times, as is suggested in the Office Action, would not result

in a method that reads on the claimed method. Repeating a step of immersing the polymer electrolyte in the absorption solution would not constitute a pre-treatment swelling step as defined in the claims because such immersion would never be done before the electrolyte plating of the polymer electrolyte according to the Fedkiw process. Instead, as described above, the solution including the ionic salt or salts of the desired metal represents part of the plating process. On the other hand, the claimed methods include the use of a pre-treatment swelling solvent which is allowed to permeate the polymer electrolyte before the plating process.

It has been found that a laminate where the metal layer is formed on a polymer electrolyte which undergoes a pre-treatment swelling step before electroless plating has been observed to have a larger electrical capacity compared with a laminate formed from a polymer electrolyte which does not undergo the pre-treatment step. (Specification, page 11.) As a result of the swelling of the polymer in the pre-treatment stage, the degree of crystallization in the polymer decreases, the inter-twisting of side chains having functional groups is moderated, and the degree of freedom in the segmental motion with respect to the side chains increases. (Specification, page 12.) This pre-treatment step occurs before electroless plating of the polymer electrolyte through adsorption and reduction of a metal complex. Performing the pre-treatment swelling allows the metal complex and reductant to more easily permeate into the polymer electrode and a metal layer having a larger surface area can be formed. The pre-treatment swelling step is, so to speak, a "reformulation" of the polymer electrolyte performed prior to electroless plating. The Examples prove that swelling the polymer electrolyte before plating creats laminates having improved electrical characteristics.

Fedkiw also fails to teach or suggest the degree of swelling defined in the claims. The Office Action asserts that one skilled in the art would find it obvious to perform routine experimentation to optimize the amount of swelling. Applicants respectfully disagree. Instead, the claimed degree of swelling appears to be well beyond that contemplated by the cited art. For instance, Fedkiw uses, in Example 1, a

product called NAFION 117. NAFION 117 is manufactured by DuPont. According to a catalogue of DuPont (Exhibit A; available at:

http://www2.dupont.com/FuelCells/en_US/assets/downloads/dfc101.pdf),

the change in the degree of thickness of NAFION 117 when soaked in water is 10% at 23°C and 14% at 100°C. That is, it appears that the considerably higher degree of swelling achieved through the present invention constitutes more than just a routine adjustment of what is known in the art.

Accordingly, Applicants respectfully submit that the pending claims are patentable over Fedkiw and the rejections based thereon should be reconsidered and withdrawn.

CONCLUSION

For the foregoing reasons, Applicants submit that the pending claims are patentable over the cited documents of record and are in condition for allowance. Accordingly, reconsideration of the outstanding rejections and allowance of pending claims 1-8, 13-14 and 16-23 is respectfully requested.

Respectfully submitted,

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